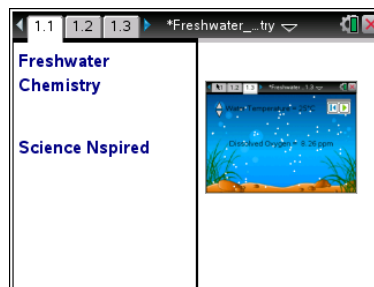


Open the TI-Nspire document *Freshwater_Chemistry.tns*


How well do aquatic organisms tolerate changes in **pH levels**, **temperature**, and **dissolved oxygen** in their aquatic environments? These and several other factors are involved in determining the quality of water in a river, lake or stream environment. By manipulating the amounts of these factors, you will determine the range of tolerance for aquatic life in a lake.



Move to page 1.2. Answer question 1 below and/or on your device.

- Q1. What happens to the amount of oxygen that can be dissolved in water as the temperature of the water increases?
- A. There is less oxygen in the water.
 - B. There is more oxygen in the water.
 - C. There is no change in oxygen in the water.

Move to page 1.3.

1. After reading the instructions on page 1.3, close the directions box by selecting .
2. To begin testing, select the Play button. Select the up and down arrows (▼ and ▲) of the Water Temperature to increase and decrease the temperature. Assume that all other water quality factors will remain the same while changing the temperature. Observe how dissolved oxygen levels change as you change the temperature.
Note: Do not reset the simulation yet.



Move to pages 1.4 – 1.7.

After examining the data in the spreadsheet on page 1.4 and the graphic representation on page 1.5, answer questions 2 – 4 below and/or in your .tns file.

- Q2. Is the relationship between the temperature and dissolved oxygen (DO) linear? Yes or No?
- Q3. Support your answer by explaining how you interpreted the data.
- Q4. As the temperature of the water increases, the amount of oxygen dissolved in the water also



increases. True or False?





Tech Tip: To scroll through data in the spreadsheet on screen 1.4, press your finger anywhere on the screen and drag it up or down.

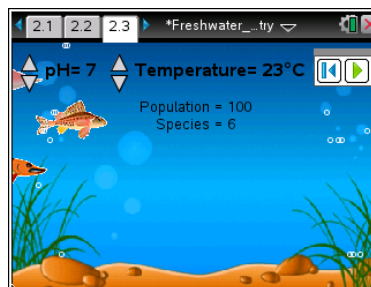
Move to Page 2.1. Answer question 5 below and/or in your .tns file.

Q5. Predict the effect of an increase in water temperature on fish living in a lake.

- A. The fish would swim faster.
- B. The fish would have trouble breathing.
- C. There would be no effect on the fish.

Move to pages 2.2 – 2.3.

3. Read the instructions on page 2.2. Next, read the directions on page 2.3, and then close the box by selecting . To begin the simulation, select the Play button. Note that to change the temperature after starting the simulation, you need to select the Pause button  to stop the action.



In this experiment, **ONLY CHANGE THE TEMPERATURE** variable for this experiment. Keep the pH value at 7. Otherwise, you will not be able to tell which variable is affecting the fish!

4. Record changes to the number of fish in the population and number of species present in the data table provided below. Again, assume that all other water quality factors remain the same while temperature is changed.

Effect of Temperature on Freshwater Fish Species

Temperature (°C)	Number of Fish in Population	Number of Species in Population	Temperature (°C)	Number of Fish in Population	Number of Species in Population
10°			26°		
12°			28°		
14°			30°		
16°			32°		
18°			34°		
20°			36°		
22°			38°		
24°			40°		



Move to page 2.4.


After examining the data recorded above in your spreadsheet, answer question 6 below and/or in your .tns file.

Q6. What is the best temperature range for fish in this lake?

Move to page 3.1. Answer question 7 below and/or in your .tns file.

Q7. Do you think the pH of the water will affect the fish in a lake? Yes or No?

Move to page 3.2.

- After reading the instructions on page 3.2, **return to page 2.3** and select the Reset button .
- In this experiment, change the value of the **pH level ONLY**. Then, record changes to the number of fish in the population and number of species present in the data table provided below. Again, assume that all other water quality factors remain the same while changing the pH.

Remember: To change the **pH** after starting the simulation, you need to select the Pause button.
ONLY CHANGE THE pH slider for this experiment. Keep the temperature at 23 °C. Otherwise, you will not be able to tell which variable is affecting the fish!

Effect of pH on Freshwater Fish Species

pH value	Number of Fish in Population	Number of Species in Population
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		



Move to page 3.3. Answer question 8 below and/or in your .tns file and answer question 9 on this activity sheet.

Q8. In what pH range was the number of fish species the highest in this lake?

A. 1–12

B. 1–7

C. 7–8

D. 7–12

Q9. Explain how you interpreted the data to arrive at your answer to question 8.

Move to Page 3.4. Answer question 10 below and/or in your .tns file.

Q10. You are working for your state's DNR (Department of Natural Resources). You have just tested a freshwater pond. If it is a "healthy" body of water, what range of values would you expect for its temperature and pH?